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Cluster observations of isolated multi-domain magnetospheric incursions into the dawnside magnetosheath

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From the observations of the 4 Cluster spacecraft, we found several magnetospheric incursions into the dawnside magnetosheath (Ygse∼-18 Re). These incursions are composed of 2 or more successive magnetospheric domains characterized by different particle distributions, electrostatic and electromagnetic emissions and sometimes different magnetic field B directions.
While observed during quiet geomagnetic activity (Kp < 3-4), these successive domains always present plasma flows with different orientations. Each of them is also very often preceded and succeeded by a compression of B. In some cases, an enhancement of the field-aligned current or a burst of electromagnetic waves – typical of the magnetosheath – is detected between two of these domains.
Even though crossed behind the terminator (Xgse down to -6 Re) and at high altitude (|Zgse| up to ∼9 Re), some of these domains contain isotropic flat-topped ion distributions. This kind of configuration is often observed within the tail plasma sheet and could constitute the next evolution step of the shell distributions described by Elphic and Gary (1990) and by Onsager et al. (1991) in the plasma sheet boundary layer. They could then result from the combined effects of an ion-ion interaction between injected and mirrored ion beams in the deep magnetotail and of an adiabatic unfolding of pitch-angles while approaching the Earth. Another possibility would be a local creation of these flat-topped distributions.
From several examples, we will consider how those mechanisms, understood in the nightside magnetotail (∼+/-1 MLT), can apply to the dawnside magnetosphere (∼5 MLT).